SIMULATION OF TRAFFIC SIGNAL USING FUZZY LOGIC

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I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the degree of *Doctor of Philosophy/ Master of Engineering/ Master of Science in ……..

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Tujuan tesis ini adalah untuk membangunkan sistem kawalan trafik yang pintar untuk mengawal aliran lalu lintas yang optimum di persimpangan lalu lintas. Cadangan sistem “fuzzy” telah digunakan dalam kajian untuk mengurus persimpangan lalu lintas bandar di Malaysia dengan berkesan. Kepentingan sistem kawalan lalulintas pintar yang dicadangkan terdiri daripada pertimbangan ketidakpastian dan kekaburan maklumat mengenai nilai parameter input dan output sistem. Dengan menggunakan parameter input berdasarkan kesimpulan dari peraturan kabur, pengawal lalu lintas. Kajian ini telah melakar Simulasi dengan mengguanakan Software Matlab dalam sepanjang eksperimen. Lampu isyarat hijau dapat ditentukan dengan berkesan dengan menggunakan enjin inference Mamdani. Trafik pintar yang berkesan dapat diaplikasi dalam projek ini dengan menggunakan pengawal trafik kabur dengan empat parameter input trafik.

ABSTRACT

The aim of this thesis is to simulate the fuzzy intelligent traffic for the optimal controlling of the traffic green signal flow at the traffic intersections. The proposed fuzzy control system is used to effectively manage the urban traffic junction of the intersections in Malaysia. The importance of the proposed fuzzy intelligent traffic control system consists in consideration of uncertainty and vagueness of information about the values of the input and output parameters of the system. Using the input parameters and based on the inferences from the fuzzy rules, the fuzzy traffic controller decides the priority street to become the green light on the next phase in the traffic intersection. Computer simulation is carried out using Matlab software. The result of select the green light on the intersection road is purposed using the Mamdani inference engine. The effectiveness of the fuzzy traffic controller with four input parameters is explained.

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LIST OF SYMBOLS

Z*	difference between the mean of the variable in a sample set
dx	an infinitely small width of x
$\int$	Opposite to derivation
ĉ	c with a bar over it
µ	small

LIST OF ABBREVIATIONS

SBPWM	Simple Boost Pulse Width Modulation
ZSI	Z source inverter

CHAPTER 1

INTRODUCTION

1.1 Background History

The aims of install the traffic light is to control the traffic flow due to the increasing of the volume of vehicles on the road. According to (Skabardonis et al., 2014) presented even the technology growing fast and the changes of the social structures brought us huge benefit in growth of economic, infrastructure, education but at the same time the changes also can be lead to some disadvantages indirectly. The impact of the changes leads to the serious problem which is traffic problem. The size of the community growth rapidly nowadays is one of the issues turn to traffic problem. Furthermore, it will become a complex problem for the urban workers especially who are working in the urban city if we let the problem go unsolved (Times, 2017). Table 1.1 shows the table of the most method used in transportation in Malaysia.

Table 1.1 The Most Method Used in Transportation

Type of Vehicle Used	Kuala Lumpur		Other		Grand Total	
	Frequency	%	Frequency	%	Frequency	%
Private Car	120	52.2	156	57.8	276	55.2
Motorbike	55	23.9	68	25.2	123	24.6
Private Bus	40	17.4	37	13.7	77	15.4
Taxi	15	9	9	3.3	24	4.8
Total	230	270	270	100	500	100

In the survey of Table 1.1 shown us the most method used in transportation in Malaysia. Table 1.1 prove that most of Malaysian rely on private cars as the most transportation strategic where 55.20% of the residents use their own car as main transportation. The table show that there are only 15.4% of the respondents using bus as their transportation. As the result that we can conclude from the Table 1.1 that one of the

main problems lead to traffic congestion is increasing the use of the private cars on the road.

It is necessary to having a method that can reduce the traffic problem especially at the traffic intersection. One of the best ways to minimize the situation happened is control the traffic light between the consecutive traffic intersections(Chansiri Suksri, 2011). As the density of the vehicles move in traffic road getting more nowadays in Malaysia, it is better to having an intelligent traffic control system to improve the traffic flow problem.

The common used method of installing the traffic light in Malaysia is "Preset Cycle Time (PCT) Controller where it is a control framework where it is a fixed control of traffic light followed the priority of the structure cycle time and there could manual control the setting of the traffic light based in research (Krzysztof, 2016). The PCT use the fixed control plan where the green time is fixed under the plan without considering the situation on the road.

Vehicle Activated (VA) Controllers is another customary traffic light framework recently, (Jomaa, 2014) shown that the different method used in VA is installed magnetic sensor at the end of each road intersection and the sensor is not obvious to see compared to the dark rectangular line which next to the traffic light. There are three parameters used in VA: Beginning Interim, Extension Unit and Extension Limit, the concept is focus on the changes of the cycle traffic light depends on measurement of limitation units of cars which cross over the junction road and also reached the exceeding limit of the cars in the every phase on the road. If the green phase were reached the maximum limitation units of cars crossing it will directly turn to red phase without considering the volume of each intersection road.

As the usage of the vehicles on the road getting high nowadays while the current control traffic light system does not improve the traffic congestion effective. Thus, the traffic control system is needed to overcome traffic jam and improve the efficiency of the traffic flow in order to help community to reach their destinations safely and quickly.(Karmore2, 2012)

In order to solve the congestion problem by optimize the appropriate timing of each road in the intersection based on the current situation, a model call Fuzzy Logic has been proposed in this project. According the research from (I.N.Askerzade (Askerbeyli), 2010), by implement of FL model, the result will show an appropriate direction of the green light on each road in traffic intersection to improve the efficiency of traffic flow and minimize the traffic congestion.

1.2 Problem Statement

The traffic congestion in urban areas became serious depends on the car moving increased on the road. According to the traffic situation presented by (K. Mahirah1, A. A. Azlina1, 2015), most of the traffic light in Malaysia used a fixed traffic control plan which resulting inappropriate behaviour in traffic where the system are based on the traffic counts and its sometime will changed manually. In order to make the traffic flow to become smoothly and safely, it is necessary to implement an efficient algorithm to reduce the traffic congestion in the road intersection.

Most of the traffic light in Malaysia installed fixed-time controller called “Preset Cycle Time”(PCT) (Jomaa, 2014)as main traffic flow controller especially in the urban area. This fixed time controller is using the fixed plan to control the red, yellow and green colour of the traffic light. The advantage of installing the fixed time control is it is very easy to control as the duration time of the green time is fixed for every traffic phase and cycle on each of the road while the disadvantage is it does not consider the density of the vehicles. Based on the paper from (Project Scholar, Dept. of Computer Science and Engg., G. H. Raisoni College of Engineering, Nagpur (MS), n.d.) the concept on the fixed-time controller is being an open-loop system where the green time is fixed followed the setting of controller and it is not extended time if there is full of cars at the junction. Nevertheless, these times is fixed for all phase and its will up to a maximum of the time limit. It can be found in the case of traffic situation the green time is set to be seconds which until the maximum time limit when a car is detected.

For the purpose to enhance the effectiveness of traffic flow in intersection, a suggested algorithm fuzzy logic is proposed in this project which is a real time controller where the system could control the direction of green light in the intersection road depends on the traffic volume and minimize the waiting time on a single intersection. The

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